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ABSTRACT

A study was done to lay the foundation for a rigorous analysis and assessment of the functioning of the Canadian academic labor market and to begin to explore systematically the dynamic of faculty renewal and replacement. The study used data from Statistics Canada and investigated the functioning and prospects of the Canadian academic labor market at the aggregate level of total full-time faculty. Analysis was at the "system" rather than discipline level with projections to the year 2000. The findings indicated that for the period 1990 to 2000 annual faculty requirements are projected to increase faster than the number of doctoral graduates. At the aggregate level, critical shortages will develop in selected disciplines particularly in natural sciences and engineering. Furthermore, anticipated faculty shortages in the United States could exacerbate the projected Canadian shortages by drawing Canadians to positions out of the country. The study's projections suggest that Canadian universities must maintain or increase their share of doctoral graduates, expand doctoral programs especially in the natural sciences, and reduce the number of faculty who leave academic faculties for reasons other than retirement. An appendix contains 18 tables and a bibliography lists 18 items. (JB)

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AVERTING FACULTY SHORTAGES

A Discussion Paper on the Canadian Academic Labour Market in the 1990s

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AVERTING FACULTY SHORTAGES

A Discussion Paper on the
Canadian Academic Labour Market in the 1990s

Prepared by the
Research and Policy Analysis Division
Association of Universities and Colleges of Canada
September 1991

$9.95

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EXECUTIVE SUMMARY

Rationale for the study

For a number of years there have been grave concerns within the Canadian university community that it would soon face acute shortages of faculty in almost all fields of study. The concerns arose primarily from the conviction that a wave of retirements would overwhelm the capacity of the Canadian labour market to supply adequate numbers of qualified full-time faculty.

The widespread concerns about an impending faculty shortage remained largely impressionistic however. Even existing studies of the question extrapolated the impending challenge by simply projecting into the future the age distribution of faculty in a given year, ignoring the fact that faculty leave academe at all ages and departing faculty are replaced by individuals of all ages.

The objective of this AUCC study was to lay the foundation for a rigorous analysis and assessment of the functioning of the Canadian academic labour market and to begin to explore systematically the dynamic of faculty renewal and replacement.

Based entirely on data available from Statistics Canada, the study investigated the functioning and prospects of the Canadian academic labour market at the aggregate level of total full-time faculty. Part-time faculty were not included. Analysis was at the "system" rather than discipline level. Student/faculty ratios were not taken into account, nor were qualitative issues such as employment equity policies. Projections were to the year 2000. The rationale for these study parameters is contained in the Methodological Considerations.

Key findings

For the period 1990 to 2000, annual faculty requirements are projected to increase faster than the number of PhD graduates. According to the base scenarios, faculty replacement needs would exceed available supply at the aggregate level if recent trends in faculty growth, retirement, other attrition and PhD graduates continue to the end of the 1990s.

While it was not possible to examine different disciplines in detail, the problems identified at the aggregate level suggest that critical shortages are likely to develop in selected disciplines. For example, the prospects of continued growth in the number of PhD graduates vary by area of study. In the natural sciences and engineering, the number of PhD graduates will decline in the latter part of the 1990s unless universities are able to increase the retention of bachelor's students through to PhD graduation.

Furthermore, Canada's academic labour is part of a wider national and international labour market for highly qualified personnel. Changes in other labour markets in Canada and abroad also affect the ability of universities to attract and retain academic

staff. Recent studies project widespread faculty shortages in the United States by the mid 1990s. Given the size of that market, shortages in the US could significantly exacerbate the problems projected under the baseline scenarios by increasing attrition rates in Canadian universities and reducing the share of PhD graduates available to Canadian universities.

The projections of supply and demand based on historical trends, combined with the generally accepted international need for more highly qualified personnel suggest that Canadian universities will confront at least three challenges in order to avert critical faculty shortages. Specifically, universities will need to:

* Maintain and preferably increase their share of PhD graduates.

* Continue expanding their PhD programs, especially in the natural sciences where shortages appear to be particularly acute.

* Reduce the number of faculty who leave the academic ranks for reasons other than retirement, thereby minimizing the number of faculty they have to replace.

Faculty shortages will be a very serious problem for Canadian universities over the course of the next decade. Such shortages could threaten the quality of university education in Canada and our ability to compete effectively in the 21st century with other countries with knowledge-intensive economies. Action is required now to avert these shortages.

PREFACE

For a number of years there have been grave concerns within the Canadian university community that it would soon face acute shortages of faculty in almost all fields of study. The concerns arose primarily from the conviction that a wave of retirements would overwhelm the capacity of the Canadian labour market to supply adequate numbers of qualified full-time faculty. The simple, if inelegant image of the Canadian university "system" was that of a snake swallowing a watermelon. Large numbers of faculty had been hired during the rapid expansion of universities in the late 1960s and early 1970s. These faculty members were now aging "through the system" and would all retire at about the same time.

The widespread concerns about an impending faculty shortage remained largely impressionistic however. Even existing studies of the question extrapolated the impending challenge by simply projecting into the future the age distribution of faculty in a given year. This static technique entirely ignored the central issue of faculty flows into, within and out of academe. Essentially, such studies ignored the simple fact that faculty leave academe at all ages and departing faculty are replaced by individuals of all ages.

The AUCC decided to launch a research project in late 1989 in order to fill this knowledge and information gap. The objective of the study was to lay the foundation for a rigorous analysis and assessment of the functioning of the Canadian academic labour market and to begin to explore more systematically the dynamic of faculty renewal and replacement. The study sought to provide an empirical basis to the discussions of the challenge of faculty renewal. It was hoped also that by raising questions and identifying unresolved issues the study would encourage more research into an issue that could have a determining influence on the quality of university education and research.

Based entirely on data available from Statistics Canada, the study investigated the functioning and prospects of the Canadian academic labour market at the aggregate level of total full-time faculty. This limitation has meant that significant dimensions of the academic labour market were ignored from the analysis most often because of the absence of comprehensive data and the limited resources available.

First, the study did not consider the role part-time faculty play in the current context, as well as their role in a potentially tight labour market. Little is known about this diverse group of teachers, thereby making it virtually impossible to make reasoned assumptions about the number of part-time teachers who could be considered as qualified candidates for a regular faculty position. It should be noted however that full-time faculty include individuals appointed for a limited term of four months or more.

Similarly, the study did not take into account student - faculty ratios which are often one of the cornerstones of similar American studies. We held the view that while these ratios may condition staffing decisions at the micro level, such decisions are more sensitive to public funding policies at the aggregate or system level. In any event it

would have been almost impossible to calculate student - faculty ratios accurately in the absence of reliable data on part-time faculty.

Reliance on readily available data has meant that the brain drain issue was virtually ignored from the analysis. The study does point out, however, that Canada's reliance on the international academic labour market makes our universities most vulnerable to changes in market conditions, especially to the projected shortage of faculty in the United States.

The study did not attempt to conduct separate and detailed analyses based on the type of appointment held by faculty. Consideration of this dimension would have enabled the study to shed light on the nature of the impending challenge by distinguishing between tenured or tenure stream faculty and full-time professors who hold limited term appointments.

Gender differences were similarly excluded from the analysis. Gender is an especially important dimension on the supply side of the academic labour market equation. Already qualified female candidates are in short supply in numerous disciplines and entire fields of study. These problems will undoubtedly become more acute as the number of vacancies to be filled increases and universities struggle to implement employment equity policies. This type of question requires separate analyses, especially with regards to the obstacles preventing women from pursuing graduate studies as well as academic careers.

The reliability of the detailed data made available by Statistics Canada and the resources at our disposal made it impossible to conduct separate analyses of faculty "demand" by field of study, let alone by discipline. Supply and demand patterns will inevitably differ by field of study. For example, the analyses of graduation patterns conducted for this study suggest that the prospects for engineering will likely differ from those for the social sciences.

Despite its limitations, I hope this study will contribute both to a better understanding of the functioning of the academic labour market and to a clearer appreciation of the challenge of faculty renewal and replacement facing Canadian universities. More importantly perhaps, I hope this study will inspire academic and policy researchers to investigate this question in more detail than it was possible in this study. The issue is too important and the resources available too scarce for the university community to rely on foreign studies and quick fix solutions.

Robert Davidson
Director
Research and Policy Analysis

AVERTING FACULTY SHORTAGES:
The Canadian Academic Labour Market in the 1990s

A. BACKGROUND

During the 1960s, higher education was prominent on the public agenda throughout the Western industrialized world. In Canada, this era of unprecedented expansion has been referred to as the golden age of higher education. The foundation of Canada's current university "system" was laid during this brief period. Canadian universities expanded at such a rate that they experienced serious shortages of faculty. The severity of those shortages was largely due to the limited size of the country's graduate studies programs. The existence of a sellers' market compelled Canadian universities both to hire individuals who had not obtained their PhDs and to recruit extensively on the international market, especially in the United States.

The golden age was short-lived. By the mid-1970s, financial constraints forced universities to limit the growth of their full-time academic staff. At the same time, increasing enrolment had produced a growing number of PhD graduates seeking university employment. Together, these factors led to an excess of potential faculty. The change from a sellers' to a buyers' market, combined with widespread concern over faculty citizenship (Symons and Page 1984), resulted in restrictions on foreign hiring. These restrictions sought to enhance the employment prospects of qualified Canadians, without diluting the merit system or infringing on academic freedom.

Since the late 1980s, concern about the Canadian academic labour market has increased. Even short-term prospects remain unclear. Many in the academic community fear renewed faculty shortages. There is no secret about the cause of this uncertainty and apprehension. Academic staff are aging. Current faculty will need to be replaced at a growing rate. There is also concern about the ability of Canadian universities to compete in the international academic labour market. In the United States, for example, faculty replacement is already referred to as a crisis. A recent study (Bowen and Sosa, 1989) concluded that, in the arts and sciences particularly, severe imbalances between faculty supply and demand would emerge by 1997. Canadian academe is very sensitive to the effects that faculty shortages in the United States have on the international academic labour market. Not only are Canadian universities keenly aware of their limited capacity to compete with American schools in a highly competitive North American labour market, but they also fear a "brain drain." The spectre of the 1960s, when Canadian universities experienced a shortage of qualified candidates, has made replacement of academic staff a priority.

The widespread concern about an impending faculty shortage in Canada remains based largely on local conditions or anecdotal information. There is no comprehensive assessment of the functioning and prospects of the academic labour market. As a result, the Association of Universities and Colleges of Canada (AUCC) established a formal research project in 1990. Its purpose was to examine systematically the nature and

extent of faculty replacement needs facing Canadian universities. The study had three main objectives:

- to shed light on the academic labour market's functioning in Canada;
- to test commonly-held impressions of an impending faculty shortage in all fields of study; and
- to develop a methodology able to test a variety of scenarios.

The study sought to provide a sense of whether the "boom and bust" pattern of academic staffing was likely to repeat itself. Universities could then acquire a better understanding of how to avoid such disruptive and wasteful cycles.

This discussion paper is divided into five sections. The first outlines the study's scope and methodology. This is followed by a description of the historical functioning of Canada's academic labour market. The next two sections provide projections of the future supply of and demand for academic staff. The paper ends with a summary of the study and its conclusions.

B. METHODOLOGICAL CONSIDERATIONS

1) Factors restricting the scope of the study

The study investigated the functioning and prospects of the Canadian academic labour market at the level of total full-time faculty[1]. Part-time staff were excluded from the analysis largely due to a lack of comprehensive data[2]. These questions and others, such as the participation of women in university education and research, require separate and intensive analysis.

Although not central in the study, the regional and field of study dimensions of faculty renewal were considered. As will be shown, the prospects for engineering, for example, will likely differ from those for the social sciences. As well, the regional dimension of faculty replacement was addressed through the exploration of inter-institutional mobility. The study showed that inter-university mobility will have a significant impact on faculty replacement and renewal in the various regions of the country. However, the quality of the data available from Statistics Canada was insufficient to sustain detailed analysis at the field of study or provincial level, using the methodology adopted in this project.

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[1] For Statistics Canada, full-time academic staff include teachers in the professorial ranks plus instructors and lecturers appointed on a full-time basis for four months or more. Also included are those appointed on a reduced-load basis as a result of a formal agreement with the institution to carry out a fraction of a normal full-time load. Full-time faculty, therefore, includes both tenured or tenure-stream faculty and individuals hired on a limited term appointment.

[2] Yet "part-time" faculty was partly captured with the inclusion of sessionals and other limited term appointments.

Though most American studies consider student-faculty ratios in projecting future faculty needs, such ratios were not taken into account in this study. While student-faculty ratios may affect decisions about staffing needs at the departmental level, at the aggregate level, staffing decisions appear more sensitive to public funding policies. The base projections employed in the study assumed that in the 1990s total full-time faculty would continue to grow at the same average annual rate as in the 1980s. This presumed that the financial situation of universities would not deteriorate further or improve significantly during the projection period.

The study was based entirely on data available from Statistics Canada. It was, therefore, limited to the quantitative aspects of faculty "supply" and "demand" captured by Statistics Canada's data files. There was no attempt to assess qualitative dimensions of faculty replacement, such as the impact of employment equity policies and the quality of the candidates.

Crucial information was often lacking, even at the global level. For example, how many tenured or tenure-stream positions were left unfilled annually or filled temporarily? How long did such situations persist? Similarly, without exit interviews, there were no data on the reasons why faculty left academe and where they went.

While supply and demand terminology is used in this report, it is in no sense an econometric analysis. The terms supply and demand are used broadly to represent the expected number of candidates available for vacant positions and the expected number of positions to be filled. The report focuses on the shifts in faculty supply and demand. The report ignores the shapes of supply and demand curves, which can be seen as a function of salaries and other conditions of employment at points in time. We discuss adjustment mechanisms, including both demand- and supply-side responses to changing labour market conditions, but price variables played no role in our effort to project longer-term trends.

Projections and labour market conditions primarily quantify the consequences of various assumptions about the future. These projections are not predictions. Our objective is simply to provide an early-warning system to assist decision-makers to anticipate emerging problems in time to take corrective measures. The projections can also help to inform career choices.

We sought to construct methodological models to generate various projections of faculty supply and demand. By exploring different scenarios, it was possible to test the effects of alternative assumptions. For example, the study showed that certain factors, such as attrition of faculty for reasons other than retirement, had a higher quantitative impact than retirement patterns.

The projection period for faculty is from 1989 through 2000 and for PhD graduates, from 1990 to 2000. We did not extend the projection period beyond 2000 because of the limited historical data on which to base projections. Because projections were limited to the year 2000, undergraduate enrolment was projected for only one year.

The supply-side data on the academic labour market were very limited. Reliable data on important elements of enrolment and degrees awarded were not available. These included the citizenship of PhDs awarded, the number of Canadian graduates who leave Canada, the number of Canadians returning from abroad on graduation, and the number of PhDs who immigrated to Canada.

In addition, data on the number of qualified individuals willing to accept faculty positions were not available. The focus was, therefore, on changes in the pool of qualified people. Many factors affect that pool. Chief among them is the definition of who is "qualified." Since the proportion of faculty with a PhD or equivalent has been increasing (73% in 1988), it seemed reasonable to restrict the analysis to people with PhDs.

New Canadian PhD graduates from Canadian universities are the most important element of the pool of qualified persons. Canadians graduating from foreign universities, Canadians working outside Canada, and immigrants can also increase the pool. Ideally, they should be included in the analysis of faculty supply. Unfortunately, few data were available on them, and they were excluded from the analysis.

2) Methodology

In developing projections of the supply of qualified candidates to fill faculty positions, the study focused on two questions:

- How many Canadian PhDs are universities likely to produce from 1990 to 2000?
- How many of these graduates will be available for university employment?

In the absence of reliable information on the time required to complete doctoral studies, relationships between PhDs awarded and other factors were examined to develop a reasonable method for projecting the number of PhDs to be awarded in the 1990s. It was assumed that the number of PhDs awarded would be closely related to PhD enrolment some years earlier. Empirically, the closest relationship between PhD enrolment and degrees awarded was obtained using a three-year time lag. For the human sciences, the correlation coefficient between the two was 0.885. This was a reasonably good statistical predictor. For the natural sciences, the correlation coefficient was even higher (0.979). This does not suggest that we are assuming that it takes an average of three years to complete doctoral studies. It simply means that there is a statistical relationship between total enrolment at the PhD level in a given year and the number of PhDs awarded three years later.

In projecting doctoral enrolment, the analysis was limited to examining the relationship between degrees awarded at the master's and bachelor's levels and PhD enrolment, and the relationship between enrolment at the lower levels and in PhD programs. Different time lags were used, and separate analyses were carried out for the human sciences, the natural sciences, and for all PhDs.

In these exploratory analyses, the best statistical predictor of doctoral enrolment was enrolment in bachelor's programs seven years earlier. For the human sciences, the correlation coefficient was 0.869; for the natural sciences, it was an even higher 0.957.

On the demand side, the study found that faculty entered and left academe at all ages. It also found that the Canadian professoriate was aging. This was because of the limited infusion of new blood and the higher age of new faculty members. We therefore developed a mathematical model that took into account the demographic evolution of the professoriate.

Ideally, it would have been preferable to track entry into the profession, departure from academe, and the aging process by single-year-of-age. Such an approach would have been more accurate, but cumbersome. Therefore, we opted to use five-year age groups. The demand model followed a Markov-type chain pattern[3]. The methodology produced a dynamic model in which every individual moved each year.

The model was based on a sequential series of calculations. First, trends in the growth of the professoriate were used to project annual faculty requirements to the year 2000.[4] Second, faculty attrition by age group was calculated, based on the initial (1988) age distribution of faculty, the movement of faculty to older age classes, and faculty exits for all reasons. These calculations produced two variables: a) the number of faculty remaining in each age group after attrition each year and, b) the total number of faculty remaining to start the next year. Third, the difference between total faculty requirement and the number of faculty remaining after attrition yields the number of new recruits that would be required. These new appointments were distributed across the various age groups according to the entry rate for each age group. Finally, the sum of the number of faculty remaining in each age group after attrition in each year and the number of new recruits in each age class yields the age distribution of faculty for any given year. This becomes the new starting point for the projections for each successive year in the model. A more detailed description of each of the rates used in the model follows.

- Exits - The number of exits had to be derived from two Statistics Canada files. The number of exits from a given age was computed as the difference between the total number of faculty of that age in a given year and the number of faculty, excluding new recruits, one year older the following year. The exit rate for an age group was calculated as the sum of the exits from each age in the age group,

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[3] For more details on this type of methodology, see David S. Hopkins, 1974. "Analysis of faculty appointment, promotion, and retirement policies." Higher Education 3(4): 397-418 and Barbara L. Bleau, 1982. "Faculty Planning Models. A review of the literature." Journal of Higher Education 53(2): 195-206.

[4] This assumes that universities will have the financial capacity to continue expanding their faculty complement at the same rate as during the 1980s. It should be pointed out that they may not be able to do so if their financial situation continues to deteriorate. Therefore, additional scenarios were developed to simulate the effects of various growth rate assumptions.

as a proportion of all faculty in that age group. This produces a gross exit rate, which includes deaths, retirements, resignations, and dismissals.

- Death Rate - Death rates were derived from actuarial tables. An average death rate was computed for each age group based on these tables.

- Net Exit Rate - While death accounts for a negligible number of exits in younger age groups, death rates were somewhat higher in older age groups. In order to run simulations based on reductions in the exit rate, it was necessary to produce a net exit rate so that such scenarios would not yield an exit rate below the death rate. The net exit rate was the difference between the gross exit rate and the death rate.

- Transfer Rate - The transfer rate accounts for the movement of faculty between age groups. It is the number of faculty moving from one age group to the next, as a proportion of all faculty in the younger age group. Age groups were affected by two transfer rates: transfers in and transfers out.

- Cycling Rate - The cycling rate is the proportion of faculty remaining in an age group relative to the number of faculty in that class. Because all faculty in an age group must die, exit for other reasons, transfer to another age class, or cycle in the same age group, the sum of these four rates equals one. This equation allowed us to compute the cycling rate using the following formula -- 1 minus the sum of the other three rates (death rate, the net exit rate, and the transfer rate).

These rates produced a dynamic model that accounted for the actions of every individual faculty member. The rates allocated total faculty in a given year (X) to one of twelve age groups in the following year and produced the number of faculty remaining in each age group, after attrition, in the following year (X+1).

Two additional rates were required to compute the number of new recruits and distribute them across the age groups.
The first is the faculty growth rate.

- Faculty Growth Rate - Over the period 1976 to 1988, the number of full-time faculty grew, on average, 1.2% per year.

By applying this or other growth rate assumptions, the total number of faculty can be computed for each year in the projection period. The total number of new recruits in a

given year is simply the difference between the total number of faculty that will be required in that year and the number of faculty remaining from the prior year.

New recruits were then distributed across the age groups according to the rates of entry for each group.

- Entry Rate - The entry rate is the number of new recruits in a given age group calculated as a proportion of all new recruits.

Finally, the age distribution of faculty for a given year is the sum of the number of new recruits in that year plus the number of faculty remaining after attrition from the previous year. This becomes the new starting point for the projections for each successive year in the model.

C. FUNCTIONING OF THE ACADEMIC LABOUR MARKET

Recent discussions of the prospects of the academic labour market have underestimated its dynamic and complex nature. This has led to alarm over a perceived impending crisis due to a massive retirement wave resulting from the "bunching" of faculty in the older age groups. Prospective graduate students, policy-makers, and university administrators need a realistic sense of the likely number and pattern of departures from academe over the next decade. They also require an indication of the size of the pool of potential candidates.

The objective of this section is to highlight a few key characteristics of the historical functioning of the academic labour market. This should provide a basis for the assumptions necessary in developing projections of faculty supply and demand. It will also provide a benchmark for assessing the magnitude of the projected changes on the academic labour market.

1. Appointments

The number of full-time faculty appointments made during a year is a measure of aggregate faculty demand. Table 1[5] indicates that the total number of appointments has been relatively stable for many years. After a decline in the late 1970s, the number of appointments settled at approximately 2,200 per year (6.4% of total full-time faculty) through the first half of the 1980s. It was only in 1986 that the total number of full-time appointments again reached the level of the late 1970s.

The aggregate number of full-time appointments has two components: faculty moving from one institution to another and faculty new to the university system. On average, over one-third of full-time appointments between 1976 and 1988 resulted from the

[5] See Appendix A for all tables.

movement of full-time faculty between Canadian institutions (i.e., inter-institutional mobility[6]). While the aggregate number of full-time appointments measures the level of activity in the academic labour market, it overestimates real demand for new faculty who must be hired from outside the system. Indeed, inter-institutional mobility does not require the addition of new members into the faculty ranks. Because it overestimates demand, inter-institutional mobility has been excluded from the exploration of future demand in the academic labour market.

"New" appointments or recruits are faculty who are joining the university system. Despite stable labour market conditions, universities made a total of 16,789 new academic appointments[7] between 1976 and 1986. Over this decade, universities renewed the equivalent of 53% of their full-time academic staff complement in 1976 as a result of attrition and growth. This measure provides a basis from which to assess projected changes in labour market conditions.

2. Mobility (Tables 2 and 3)

While inter-institutional mobility overestimates demand, the investigation of the flow of faculty between regions provided valuable insights into the functioning of the academic labour market. It showed that the various regions of the country will most likely confront different challenges of faculty replacement and renewal. These challenges are expected to be more pronounced in some regions than in others because of the nature of faculty movement between regions.

The exploration of inter-institutional mobility focused on two commonly held assumptions about the functioning of the Canadian academic market. It is widely believed that the Quebec academic labour market functions differently from the Canadian market. As well, it is often assumed that the centrifugal forces operating in other aspects of Canadian life operate also in the academic labour market. Hence, one would expect that the Western and the Atlantic provinces to be a source of faculty for Central Canada, especially Ontario. Both commonly held assumptions were partly borne out in fact. The vast majority of faculty movement between institutions occurs in the junior ranks of Assistant Professor and lower[8]. These faculty members account for approximately 80% of faculty mobility. Full-time faculty in both senior and junior positions generally move between institutions within their own region.

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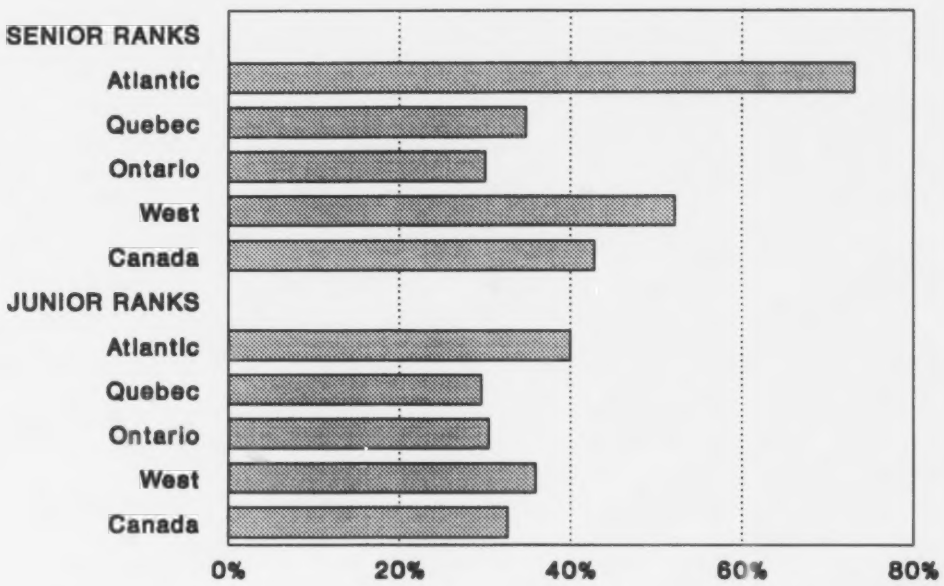
[6] Statistics Canada data files showed an annual average of 300 new appointments whose previous employment was not known. Analysis of these records did not reveal any trends that would make it possible to distribute these appointments with a minimum degree of reliability. We have assumed that these individuals were not involved in inter-institutional mobility.

[7] Throughout this report, "new appointments or recruits" refer only to faculty who are joining the university system. They exclude faculty moving from one Canadian university to another.

[8] The rank of a newly appointed faculty member in these tables is that held in the new institution, not necessarily the one held in the previous university.

In the Atlantic region (including Newfoundland), however, more senior faculty leave the region than those who simply move between institutions. In marked contrast to mobility patterns in other regions, the vast majority of senior faculty who change institutions (73%) accept a position in another region. Universities in this region appear to be losing their most senior faculty to other parts of the country. They must therefore recruit a greater number of faculty from other regions of Canada. This accounts for the net inflow of junior faculty.

PROPORTION OF MOBILE FACULTY CHANGING REGIONS, 1984 TO 1988



By comparison, Ontario universities tend to retain their senior faculty (80%) and to attract almost four times as many senior faculty as they lose to other regions. In Ontario, junior faculty account for most of the outflow. Ontario universities therefore appear to be a "breeding" ground of faculty for other regions. Moreover, the "problem" of an aging faculty may be more acute in Ontario than in any other region because of the province's ability to retain and attract senior faculty.

At first glance, Quebec appears to function as part of the Canadian academic labour market. The proportion of faculty moving between Quebec universities is not greater than in other regions of the country. In addition, a significant number of faculty move out of the province to accept positions in other Canadian universities. Yet, one indication of the distinctiveness of Quebec is that, despite the size of the professoriate, universities there recruit the smallest number of faculty from other regions. This "unequal

exchange" most likely results from the fact that relatively few anglophone Canadians are capable of teaching in French. Quebec universities, particularly francophone institutions, must therefore rely more extensively on their own provincial market and on the international market to fill their faculty needs.

The patterns of inter-institutional mobility indicated above suggest that the challenge of faculty renewal and replacement will have important regional dimensions. These regional differences have implications for academic labour market conditions in the next decade. Quebec and Atlantic institutions could become prime targets in a seller's market. Universities in Atlantic Canada could also face a double jeopardy, because they tend to rely on other regions of the country to fill their faculty needs. The only option for these institutions will be to turn to other employment sectors and to the international market to fill their faculty needs.

3. Recruitment

It has been assumed that the PhD student market is the principal source of supply of new faculty, with other labour markets in Canada and abroad playing a secondary role. However, the analysis of the sectors from which new faculty have been recruited (Table 4) revealed that the sources of supply were more diversified than has been assumed.

According to data provided by universities to Statistics Canada, on average, just 15% of new faculty were Canadian citizens recruited directly from the student market (including postdoctoral fellows) in Canada. On the other hand, approximately two-thirds of new faculty were recruited from Canada's private and public sectors (33%) and from the international market (32%). The employment experience of the remaining 20% of new appointees was not known.

But the relative unimportance of the student market is more apparent than real. In fact, a significant number of new recruits were recent graduates who had gone on, briefly, to non-academic employment after completing their PhD. The rather unexpected importance of this source of new faculty may be attributable to several factors. Many new PhDs without immediate employment opportunities in universities may have found jobs elsewhere. As well, in some fields (such as engineering), the non-academic labour market may have had attractions such as higher salaries and access to state-of-the-art laboratories and equipment, which overshadowed opportunities for academic employment.

Canadian universities also have depended heavily on the international market to fill their academic staff needs. However, such recruitment cannot be construed as hiring foreign nationals. On average, Canadian citizens accounted for 40% of hiring on the international market between 1976 and 1988. Furthermore, this proportion had been rising during the late 1980s.

These findings suggest that Canadian universities have a limited capacity to attract foreign nationals. Few Canadian institutions, if any, can marshal the resources to com-

pete with their American counterparts. Given their limited resources, it is much easier for Canadian universities to attract Canadian expatriates than to uproot foreign nationals. In the longer term, however, reliance on the international market makes Canadian institutions vulnerable to increased international competition for academics.

The relative weight of the various sources of supply of faculty is also a function of the type of positions to be filled. For example, it can reasonably be assumed that many institutions seeking to fill temporary positions to replace tenured faculty on sabbatical leave will likely limit their searches to the domestic market, rather than expending precious resources on an international search[9].

Hiring trends in the 1980s confirm this assumption (Table 5). The faculty positions filled from 1984 to 1988 were almost evenly distributed between tenured or tenure stream positions and limited term appointments (i.e., sessional, annual, visiting). More important, there is an association between the type of position filled and the recruitment sector. Whereas 66% of limited term appointments (sessional, annual, etc.) were filled domestically, this was the case for just 53% of tenure or tenure stream positions.

As noted above, limited employment opportunities in universities have forced new PhD graduates to seek employment in other sectors. Yet universities have relied extensively on this pool of recent graduates to fill their staffing needs. It seems reasonable to assume that the challenge of faculty replacement and renewal will cause universities to recruit directly from the student ranks more extensively than in the past. Moreover, it may become increasingly difficult to repatriate Canadians from abroad in a highly competitive international market.

4. Aging of the professoriate

Faculty demography lies at the heart of the widespread preoccupation with an impending faculty shortage. The threat of a massive wave of retirements is generally extrapolated from the current age structure of the professoriate. This static view ignores the fact that aging of the professoriate is a very dynamic process that cannot be reduced to the normal aging of faculty who remain in academe. Analysis of the aging process must also consider faculty growth, entry and exit patterns and how they have all combined to cause the recent aging of faculty.

Growth and attrition determine the number of new recruits who enter the profession annually. Between 1977 and 1988, growth[10] accounted for 25% new faculty appointments, on average, with attrition (i.e., retirement, resignation, dismissal, mortality, etc.) explaining the remaining 75% (Table 7). Over this period the age of these new recruits to the profession increased. For example, the number of new professors hired

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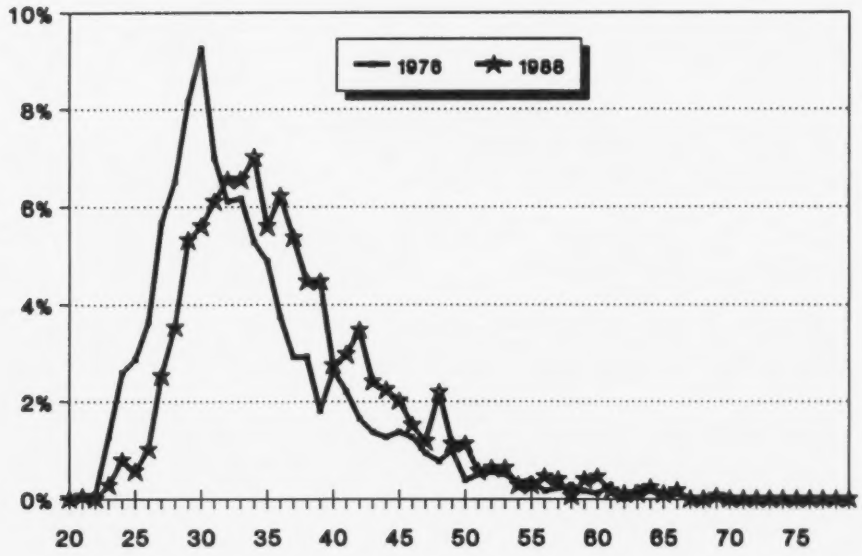
[9] However, such situations also offer opportunities to diversify faculty resources and to develop international networks.

[10] Full-time faculty grew by 1.2% per year during this period.

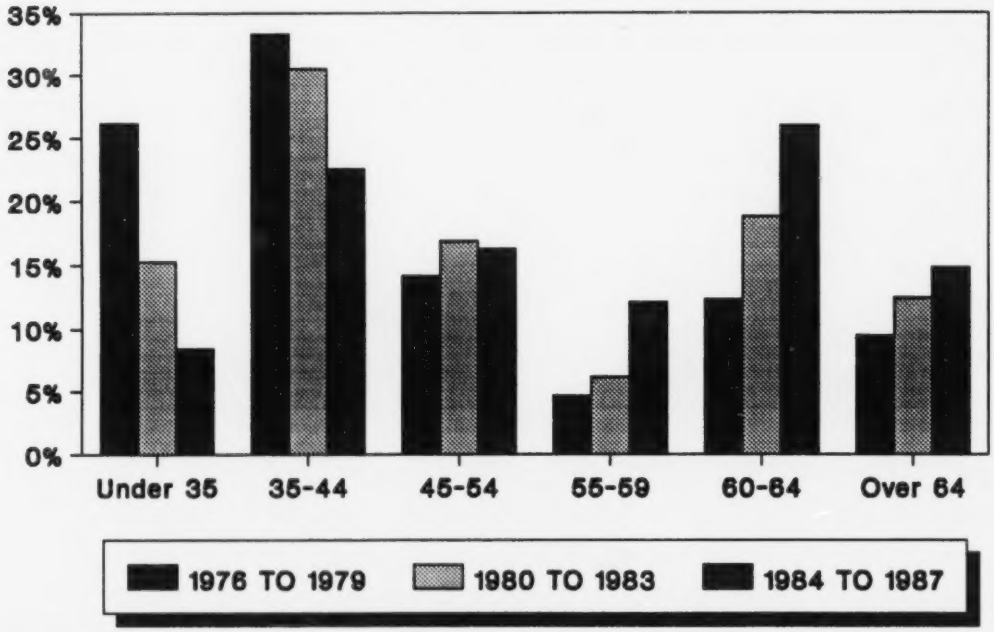
AGE DISTRIBUTION OF NEW FULL-TIME APPOINTMENTS



who were younger than age 35 has been decreasing, while the number aged 35 to 44 has been growing (Table 8). Consequently, the proportion of new faculty under age 35 fell from 62% in 1976 to 45% in 1988. There is no obvious explanation for the increasing age of new entrants into the profession. It may have been due to the aging of PhD graduates, as a result of the increasing time taken to complete their studies. It may also have been due to the higher qualifications (i.e., post-doctoral study, internships, etc.) required to enter the profession. In any event increase in the age at which new faculty enter the profession has tended to exacerbate the problem of the aging of faculty.

The age profile of the professoriate is also conditioned by trends in the age of departing faculty. Assuming that all departures after age 59 are due to retirement, the majority of departures occur for other reasons (Table 9). Indeed, between 1976 and 1979 attrition of faculty under age 45 accounted for over 60% of all attrition. It is most likely therefore that over this period a significant number of faculty hired during the late 1960s and early 1970s left academe. Although the rate at which younger faculty left the profession declined in the mid 1980s, it remains one of the most striking findings of this study.

DISTRIBUTION OF FACULTY ATTRITION BY AGE GROUP

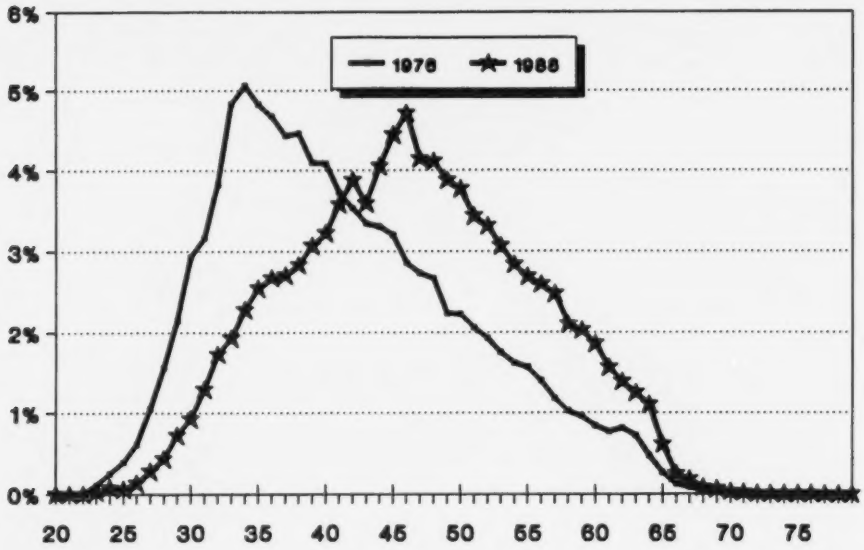


The apparent flow of newly recruited faculty from other occupations and the loss of academics to other occupations has led some analysts to conclude that net inter-occupational mobility is zero. Under this assumption, the only faculty that have to be replaced are those who die or retire. However, a comparison of the age distributions of those leaving academe and the new recruits reveals that more "middle-aged" (ages 45-59) people are leaving the profession than are entering it (Tables 8 and 9). Thus, there is a flow of experienced academics out to other occupations, and they are being replaced, for the most part, with more recent, less experienced PhD graduates. Therefore, the demand for recent graduates is also affected by attrition for reasons other than death and retirement.

Under ideal growth and attrition patterns, an age structure should repeat itself from one year to the next. It is clear that retirement creates a chain reaction in academe: leads to promotion opportunities for existing faculty and, ultimately, opens up positions for new recruits to the university system. This dynamic rejuvenates the system and stabilizes the age structure.

The Canadian professoriate has obviously not followed this ideal growth pattern. Rather, faculty ranks grew at an unprecedented rate of some 12% per year during the 1960s. This "golden age" came to an abrupt end by the early 1970s. Faculty ranks have grown much slower since, averaging 1.2% per year from 1976 to 1988. This

AGE DISTRIBUTION OF FULL-TIME FACULTY 1976 AND 1988



pattern of "boom and bust" has caused the age structure to become skewed towards the younger age groups. Consequently, a relatively smaller proportion of faculty retired during the late 1970s and early 1980s and the demand for new faculty declined. As a result, the average age of faculty increased dramatically from 41.4 in 1976 to 45.3 in 1984. In fact, aging would have been much more severe over this period if attrition rates in the younger age groups had been lower. Departures for reasons other than retirement accounted for the vast majority of all attrition.

By 1985 there were twice as many faculty over age 55 as there were in 1976 (Table 6) and attrition in this age group tripled (Table 9). Consequently, retirement has come to account for an increasing proportion of faculty attrition, from an estimated 20% in the late 1970s to some 40% in the mid 1980s. The irony of this process is that the replacement of retiring faculty has slowed the aging process. Between 1984 and 1988 the average age increased at about half the rate experienced during the previous eight-year period.

This does not imply that the growing number of retirements is not of concern to universities. In the short term, departures due to retirement may become even more significant. However, this will not translate into a wave of retirements. Many of those hired during the boom left academe for reasons other than retirement.

In summary, the age structure in academe should soon stabilize if current entry and exit patterns persist. While the number of departures due to retirement is far greater now than a decade ago, the majority of departures are still for other reasons. It brings into focus the issue of faculty retention. While we cannot now offer any clear explanation of this "leakage," it warrants further exploration.[11]

Remuneration levels may limit the capacity of universities to retain younger faculty. The Follow-up to the 1982 Graduates Survey, carried out by Statistics Canada and Employment and Immigration Canada revealed that the average salary of PhD graduates working in the university environment was second to last and well below average for employed PhDs.

As well, other employment conditions in the university sector may not compare favourably with those in other occupations. A 1989 survey of the American professoriate, conducted by the Carnegie Foundation for the Advancement of Teaching (Boyer, 1989), revealed that 44% of the respondents, and younger faculty members in particular, felt their jobs were a source of considerable strain. While 21%, again younger faculty members in particular, rated their salaries as poor.

5. Determinants of faculty supply

Although they have not necessarily been recruited directly from the student ranks, young graduates have been the principal source of faculty. The purpose of this section is to highlight trends in PhD enrolment and graduates. It focuses exclusively on Canadians (including permanent residents), because international students are not available for immediate employment in Canada. Since the citizenship of graduates was not known, we assumed that the proportion of Canadians enroled in PhD programs provided a reasonable estimate of the proportion of PhDs awarded to Canadians.

Canadian universities have expanded their PhD programs significantly since 1972. From that year to 1988, the number of Canadians enroled in PhD programs grew 65% from 9,715 to 16,085 (Table 13). However, the patterns of growth for the human and natural sciences differed. The overall enrolment increase in the human sciences was 60%, and the rate of growth has increased somewhat since 1981.

Despite a 72% increase in enrolment, growth in the natural sciences was more erratic. Enrolment of Canadians in PhD programs in the natural sciences fell in the early 1970s and remained more or less stable until 1980. But throughout the 1980s, enrolment in these fields increased dramatically.

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[11] It is possible, for example, that the leakage is concentrated in certain disciplines and fields of study, especially in the professions where ample career opportunities exist outside academe. Faculty in the more junior ranks such as Assistant Professors and sessional teachers may also account for much of this leakage. Nevertheless, the need to replace these individuals is such that the phenomenon warrants further attention.

These growth patterns are reflected (Table 14) in the patterns of PhDs awarded to Canadians. The estimated number of PhDs awarded to Canadians increased 31% from 1,424 in 1978-79 to 1,858 in 1988-89. But again, growth differed significantly for the human and natural sciences. In the human sciences, the annual number of PhDs awarded increased fairly consistently over the period, whereas in the natural sciences, the number of degrees remained stable between 1978 and 1982 and increased toward the end of the period.

Many factors were responsible for the growth in PhD output. Full-time university enrolment increased at all levels, thereby creating additional demands for PhD-holding faculty. At the same time, a substantial increase in the demand for highly qualified personnel in the government and the private sector led more students to enrol in PhD programs to maximize their employment opportunities and earnings.

6. Employment of PhDs

Data on the employment experience of recent PhD graduates are available from Statistics Canada's surveys of graduates and from the quinquennial Census.

In 1987, Statistics Canada and Employment and Immigration Canada conducted a survey of 1982 graduates, including doctoral recipients. Responses were obtained from 68% of doctoral graduates surveyed. Five years after graduation, 44.7% of those who had earned PhDs in the social sciences and humanities were working in university teaching and related occupations (Table 11). As well, relatively large proportions of these graduates were in managerial and administrative occupations (19.6%) and in occupations in the social sciences and related fields (19.4%). For the natural sciences, the proportion in university teaching was lower than in the social sciences and humanities (36.3%); in fact, the leading occupational destination of these graduates was the natural sciences, engineering and mathematics (39.7%).

The 1986 Census reported 58,740 persons with a PhD: 27,075 in the social sciences and humanities and 31,665 in the natural sciences (Table 12). In the social sciences and humanities, 53.3% reported that they were working in a teaching occupation. By contrast, only 33% of doctoral degree-holders in the natural sciences reported a similar occupation.

Unfortunately, readily available Census data did not distinguish university teaching from other teaching occupations. Consequently, results of the 1982 Graduate Survey (Table 12) cannot be compared directly with Census figures (Table 11). Nevertheless, comparisons using the broader category of all teaching occupations show that the proportion in all teaching occupations was much the same for recent PhDs as for the stock of PhDs.

D. PROJECTED SUPPLY OF ACADEMIC STAFF

The projected supply of academic staff is driven by two principal factors:

- the number of PhD degrees awarded to Canadians; and
- the percentage of Canadian PhD holders interested in pursuing academic careers.

1. Projections of PhD Degrees

The number of PhDs awarded was projected to the year 2000. These projections were based on the statistical relationship found to exist between:

- enrolment at the bachelor's level in a given year and enrolment at the PhD level seven years later (i.e., behaviour of students); and,
- enrolment at the PhD level in a given year and the number of PhD graduates three years later (i.e., graduation rate).

Assumptions about the behaviour of students were varied to produce a number of projections, although it is, of course, difficult to determine the factors influencing an undergraduate's decision to continue to the PhD level and to assess how those factors would change in the future. It can be reasonably assumed that the rates at which students undertake and continue graduate studies are conditioned by the availability of funding for graduate students and the perceived ability of universities to offer them jobs.

As well, economic factors have an important effect on doctoral enrolment. For example, if the demand for highly qualified professionals increases, doctoral enrolment will tend to increase, other factors being equal. The impact would be even greater if the net returns to a PhD increased relative to those for other types of degrees.

It was, however, particularly difficult to take account of economic factors in making projections of doctoral enrolment. The data available for exploring such relationships are limited, nor is it possible to anticipate economic changes. However, virtually all the students who will graduate with a PhD between now and the year 2000 are already enroled in universities. It was, therefore, assumed that their behaviour would remain similar to that of their immediate predecessors.

Projections of doctoral enrolment for the period 1990-2000 were derived using the relationship between doctoral enrolment and enrolment in bachelor's programs. These projections were then used to anticipate the number of PhDs to be awarded.

Over the period 1982-1988, PhD enrolment in the human sciences was, on average, 3.7% of bachelor's enrolment seven years earlier. In the natural sciences, the proportion was 5.1%. In both cases, the proportion rose consistently over the five years.

It was difficult to devise a rationale that would support a large or rapid decline in the PhD-to-bachelor's enrolment ratio. As well, demand for highly qualified personnel was projected to increase.

However, it is becoming apparent that Canadian universities are approaching or have reached the limit of their physical capacity to educate growing numbers of students. Increasingly, universities are calling for or applying enrolment freezes in order to maintain the quality of their services in an era of financial restraint. This led us to discount the assumption that the ratio of PhD-to-bachelor's enrolment would continue to grow as it had in the recent past. If the proportion was to continue increasing at the same rate as during the past five years, PhD enrolment would rise by some 60% during the 1990s. Canadian universities are unlikely to be able to accommodate such an expansion of their PhD programs without a large infusion of capital. It seemed more reasonable to assume that the PhD-to-bachelor's enrolment ratio would continue to grow, but at a slower pace.

Alternatively, institutions could deal with their capacity and financial problems by imposing ceilings or freezes on PhD enrolment. This would lead to a reduction in the PhD-to-bachelor's ratio.

In view of the foregoing considerations, it was decided to produce three sets of PhD enrolment projections[12] based on different assumptions about changes in the PhD-to-bachelor's ratio. The first set of doctoral enrolment projections (Scenario 1) assumed that the ratio would remain at the 1988 level (5.7% in the natural sciences and 4.2% in the human sciences). The second set of projections (Scenario 2) assumed that PhD enrolment would remain constant. This yielded a low projection in which the ratio fell to 5.0% in the natural sciences and to 2.8% in the human sciences. Finally, the third set of projections (Scenario 3) assumed that the proportion would change at the same rate as the average annual rate of change for the period 1986 to 1989. Specifically, it assumed that by the year 2000, the ratio would fall to 5.4% in the natural sciences and climb to 4.6% in the human sciences.

By any scenario, the human sciences will account for most of the projected increase in PhD enrolment between 1988 and 1997 (Table 13). Due to the limited size of the pool of undergraduate students from which they can draw, the natural sciences are projected to grow by 20% at most during the 1990s. Moreover, doctoral enrolment in the natural sciences will stabilize or decrease unless a higher proportion of undergraduates in this field are somehow encouraged to pursue doctoral studies.

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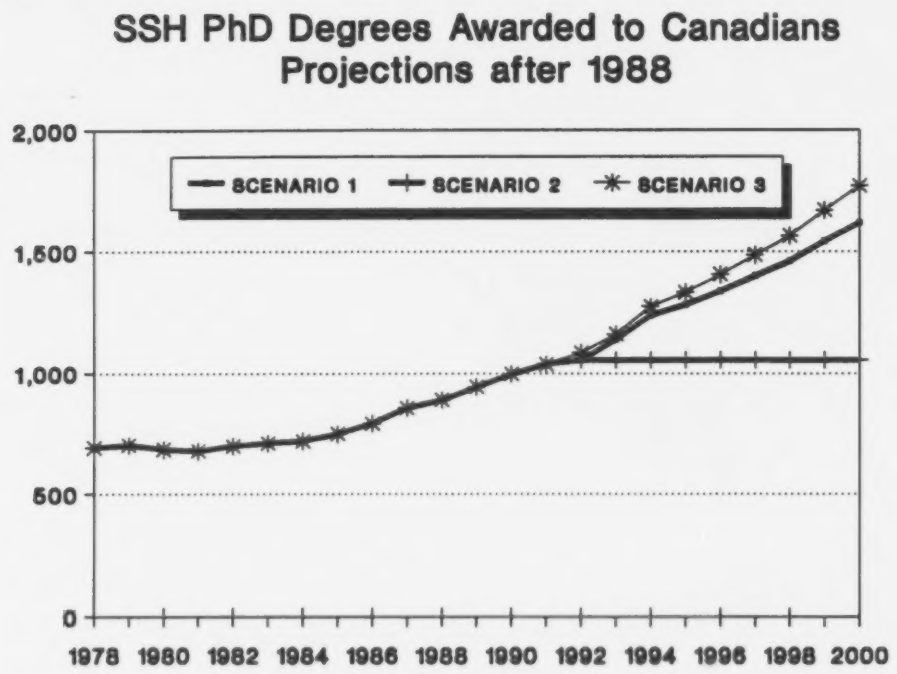
[12] Since data on bachelor's enrolment were available only up to 1989, annual projections of doctoral enrolment could be made only up to 1996. Projections of bachelor's enrolment for 1990 were required in order to obtain doctoral projections for 1997. These were calculated by assuming that the annual average change over the past three years would continue until 1990. This resulted in a 4.7% increase for the human sciences and a decline of 0.1% for the natural sciences.

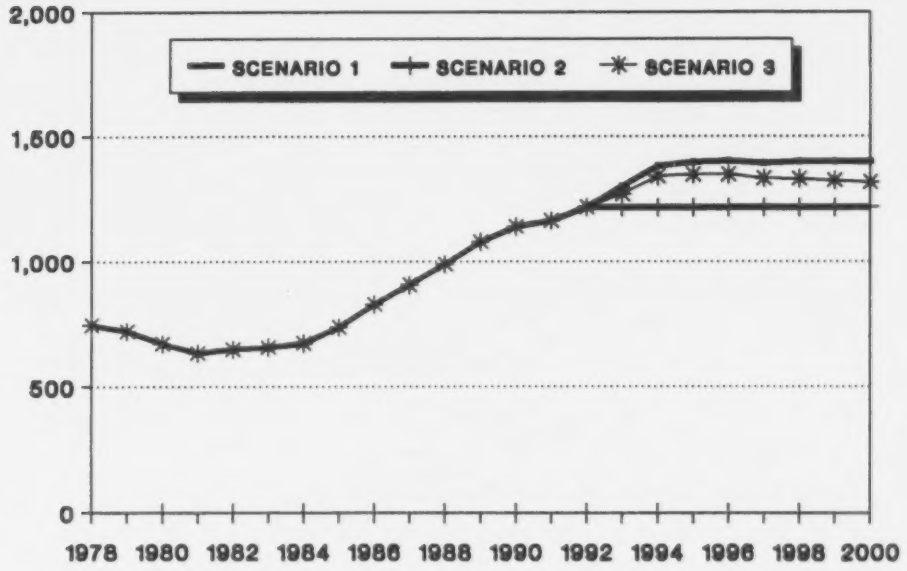
Projections of PhDs awarded were based on PhD enrolment three years earlier. Since three projections of PhD enrolment were made, three projections of PhD degrees from 1992 to 2000 were obtained (Table 14).

The projections are shown together with actual degrees awarded between 1978 and 1988 to illustrate the extent to which the projections deviate from past trends. According to these projections, the number of PhD graduates will be between approximately 2,300 and 3,100 by the year 2000, for an increase ranging from 21% to 64%.



In summary, if a freeze was imposed on PhD enrolment, the annual number of PhD graduates would remain constant after 1992. The fastest growth in the number of graduates occurs in Scenario 3 which assumes that the PhD-to-bachelor's enrolment ratio would follow trends observed between 1986 and 1989. Thus, even if a relatively smaller proportion of students continued their studies, there would be substantial growth (41%) in PhD graduates during the 1990s. In this Scenario, universities would need to expand their programs at a rate similar to that in the 1980s. Most of the growth, however, would be attributable to the human sciences; the number of PhD graduates in the natural sciences and engineering would actually decline in the mid-1990s.

NSE PhD Degrees Awarded to Canadians
Projections after 1988



2. Availability of PhD Holders

The prospect of an overall increase in the number of PhD graduates over the next decade may seem reassuring. But this assumes that universities have the means to continue expanding their PhD programs as they did during the 1980s. Moreover, the number of PhDs awarded in the natural sciences will decrease during the latter half of the 1990s unless a higher proportion of undergraduates in these fields decide to pursue doctoral studies. As illustrated earlier, not all new PhD graduates pursue an academic career: in the mid-1980s, only about 40% of recent PhD graduates were employed in the university sector.

Changes in the occupational structure of total employment over the next decade will clearly affect the availability of PhDs for employment in the university sector. Employment and Immigration Canada has projected that most of the job growth by the year 2000 will be in managerial and administrative occupations (Emplyment and Immigration Canada, 1989). Since a relatively high proportion of recent PhDs, particularly in the human sciences, have found employment in these occupations, it is reasonable to assume that this expansion would attract a large number of PhD graduates in the future.

Universities will continue to compete with other employers. But without improvements in the benefits of university employment, such as raising relative incomes, it will become increasingly difficult for universities to recruit and retain new PhDs.

The foregoing considerations led us to assume a decline in the universities' share of new PhD graduates. We assumed an annual 1% decline in the proportion of graduates going into academe in both the human sciences and the natural sciences. This reduced the supply of graduates in the natural sciences from 36% in 1989 to 32% in 2000, and in the human sciences from 45% to 40%.

Projections of the number of new PhD graduates available for university employment, assuming declining academic shares, are between 800 and 1,100 by the year 2000 (Table 15).

E. PROJECTED DEMAND FOR ACADEMIC STAFF

Faculty requirements to the year 2000 were projected using a model based on full-time faculty of known age. The model took into account past trends in growth of the professoriate, in the movement into and out of faculty age groups, and in departures from academe. The base projection showed pronounced increase in demand for new faculty from now to the end of the century.

Assuming past trends would persist, the base projection (Table 16) showed an increase in annual demand from about 1,750 positions in 1990 to almost 2,200 by the year 2000. Overall projected faculty requirements for the entire period 1990 to 2000 would be equivalent to 58% of the total full-time faculty complement in 1990. As noted earlier, the corresponding figure for the period 1976 to 1986 was 53%.

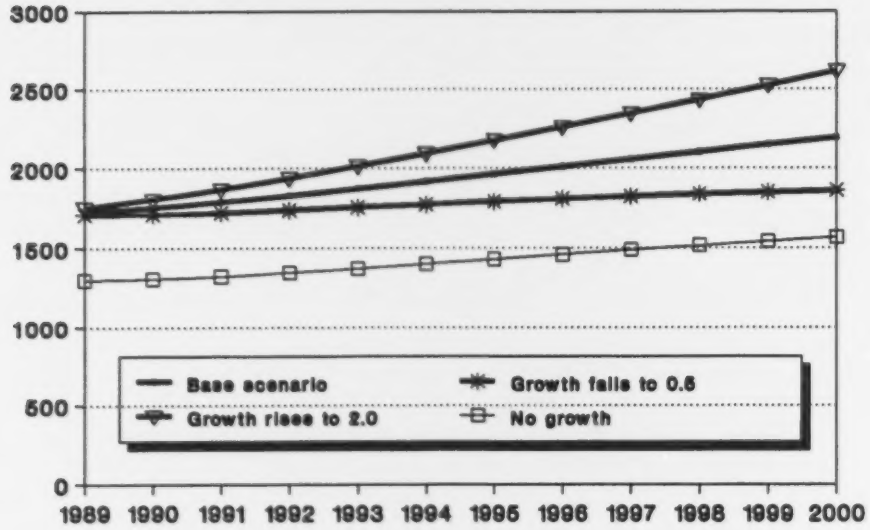
1) Simulations

These projections are sensitive to assumptions about faculty growth and patterns of entry into and departure from the profession. Simulations were performed to explore the impact of some of these factors on the projected outcome.

* Faculty Growth Scenarios

Historically, about one quarter of new recruits were hired as a result of growth in faculty. Assumptions about faculty growth have a significant impact on the number of positions to be filled (Table 16). However, even if no new positions were created during the next decade (i.e., zero growth), after an initial decline the number of new recruits would increase. In fact, the number of new recruits required by the year 2000 would be similar to that experienced during the late 1980s simply to satisfy replacement demand.

PROJECTED NEW RECRUITS
GROWTH RATE SCENARIOS



* Entry Rates Scenarios

The number and proportion of young graduates hired by universities since the late 1970s has tended to drop significantly, partly because of the lack of employment opportunities in universities. We therefore explored the effect of various hiring strategies on the projected number of new recruits. These include deliberate efforts to hire individuals in both younger and older age groups. Another scenario assumed that universities would hire equally across all age groups.

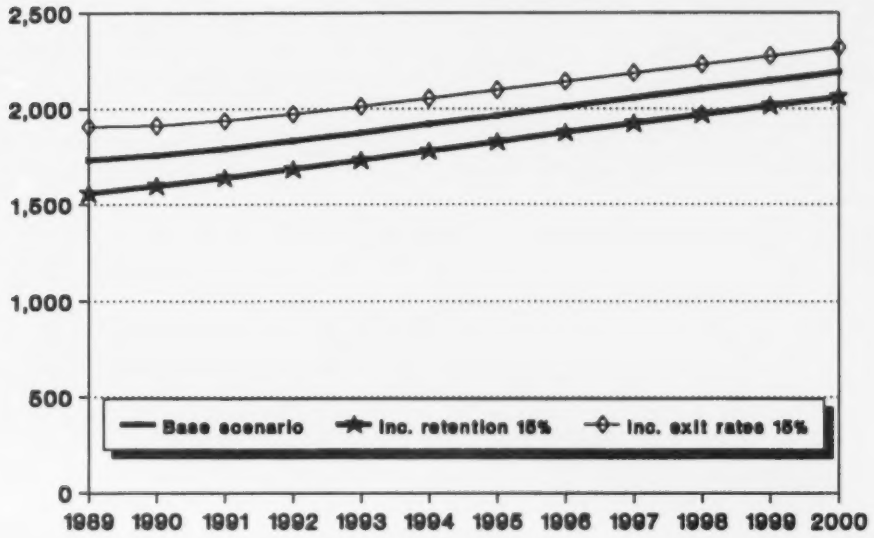
These simulations show that the net result is either negligible (hire younger) or translates into an increase in the number of positions to fill. This is largely due to the high departure rates of young and old faculty alike. In the case of a strategy that would hire equally across all age groups, universities would need to recruit some 4,000 more individuals over the 1990s than forecasted in the base projection. Thus, it appears that policies focusing exclusively on the age at which faculty enter the profession have no impact or increase demand.

* Exit Rate Scenarios

As demonstrated earlier, approximately 75% of demand has been due to attrition. The five exit rate scenarios that were developed all point to the crucial importance of

attrition (Table 16). For example, increasing retention by 15% over the 1990s would reduce demand by some 1,730 new recruits, compared with the base projection. An even greater reduction would be achieved if universities immediately hired a larger number of young graduates and increased their retention by 33%. Conversely, a strategy of hiring and retaining older faculty led to a marginal increase in the need for new recruits. These simulations clearly show that demand for faculty is most sensitive to changes in departure rates (i.e., attrition, "leakage").

PROJECTED NEW RECRUITS
EXIT RATE SCENARIOS



Yet regardless of the scenario, including a 15% reduction in exit rates, demand for faculty is projected to increase during the next decade. This is the result of the increasing number of retirements and of faculty growth. However, this outcome can be offset, at least in part, if universities succeed in retaining a higher proportion of their new faculty, especially in the younger age groups.

The analysis also suggests that demand for faculty will remain strong beyond the year 2000. According to the base projection, by the year 2000, some 48% of faculty will be over 49 years of age versus 37% in 1988 (Table 17).

In addition, Canadian universities are likely to face fierce international competition in the future. Arts and science faculty in American universities tend to be slightly older than their Canadian counterparts, so an increase in demand may affect American univer-

sities earlier. If the faculty shortages projected in the U.S. come to pass, Canadian universities will confront increasing competition from American universities, not only internationally, but also in the domestic market.

2) Projected Demand for Recent Graduates

Past experience shows that not all demand will be filled by new doctoral graduates. It seemed reasonable to assume, therefore, that demand for recent graduates will be less than the projected demand for faculty. Moreover, the fact that 33% of faculty in 1988 did not have a PhD suggests that not all faculty positions will be filled by doctoral degree-holders. Consequently, determining demand for recent PhD graduates required that assumptions be made about the frequency with which universities would hire PhD-holders and the proportion of them who would be hired from the ranks of recent graduates.

It was assumed that universities would continue to recruit PhDs as they had in the past. As a result, the proportion of faculty demand to be filled by PhD-holders was projected to increase from 67% to 74% by the year 2000.

The demand for recent graduates was more difficult to determine. One principal question concerns who is a recent graduate. Because data on the age of graduates were not available, the age of recent graduates was estimated from the PhD enrolment file by computing the average age of full-time PhD students plus three years to complete the degree. As well, another two years were added for post-doctoral studies or work experience. Calculated in this manner, the average age of recent graduates was 36 years. Historically, approximately two-thirds of new faculty have been in this age category. It was assumed that the demand for recent graduates would increase to three-quarters of projected demand for PhD-holders by the year 2000.

According to the base demand projection, the demand for recent graduates will increase by some 54% by the year 2000 (Table 18). By comparison, under Scenario 1, for example, the supply of new graduates available to teach was projected to increase by about 35%. Therefore, by the year 2000, demand under the base scenario was almost 10% higher than the supply under Scenario 1 and about 50% higher than under Scenario 2 where PhD enrolment was frozen at 1989 levels.

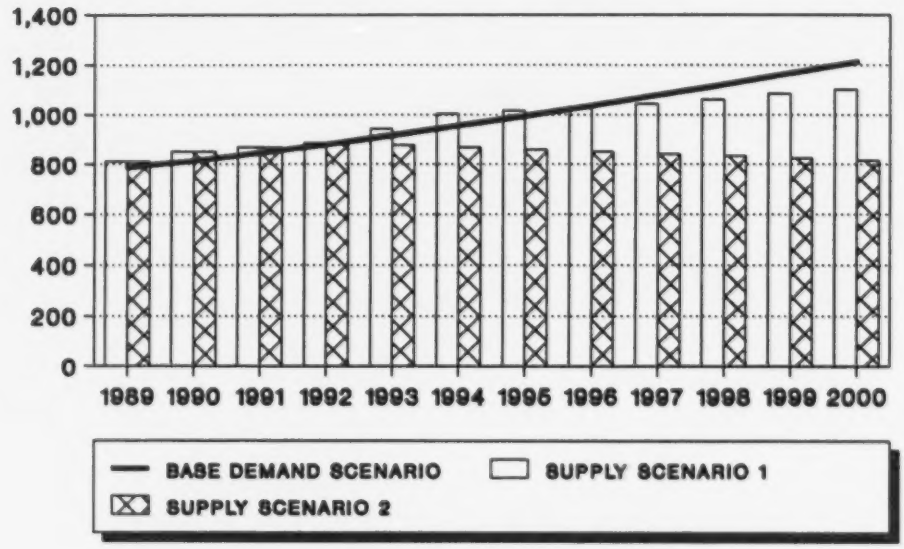
These projections also suggest that universities will confront at least three challenges in order to avert a faculty shortage. Specifically, universities will need to:

* Maintain and preferably increase their share of PhD graduates. Improving their "market share" of graduates will become indispensable if faculty is to grow at a faster pace than during the last decade.

* Continue expanding their PhD programs, especially in the natural sciences where shortages appear to be particularly acute.

* Reduce attrition, thereby minimizing the number of vacancies to be filled. Increasing faculty retention will be particularly important if faculty growth is greater than projected and/or the supply of new PhD graduates is less than projected.

PROJECTIONS OF FULL-TIME FACULTY SUPPLY AND DEMAND



F. SUMMARY AND CONCLUSIONS

This study has brought to light some essential characteristics of the Canadian academic labour market:

1. Canadian universities renewed a significant proportion (53%) of their staff between 1976 and 1986. This provides a useful benchmark from which to measure faculty replacement and renewal.

2. Annual faculty requirements for the period 1990 to 2000 are projected to increase from 1,750 to 2,200. Over this period, the number of full-time positions to be filled would be equivalent to 58% of the 1990 professoriate.

3. While universities appear to resort directly to student ranks only sparingly for staffing, they recruit many recent graduates. In fact, an estimated two-thirds of new faculty are recruited from the ranks of recent graduates.

4. The prospects of continued growth in the number of PhD graduates vary by area of study. In the natural sciences and engineering, the number of PhD graduates will decline in the latter part of the 1990s unless universities are able to increase the retention of bachelor's students through to PhD graduation.

5. Universities rely on other employment sectors and on the international market for a large proportion of their staffing. Canada's academic labour market is part of a wider national and international labour market for highly qualified personnel. Changes in other labour markets in Canada and abroad also affect the ability of universities to attract and retain academic staff.

6. The growing demand for PhDs in other sectors of the economy will likely result in a marginal decline in the universities' share of recent graduates. Some 32% of graduates in the natural sciences and engineering and 40% of graduates in the social sciences and humanities would be candidates for teaching positions by the year 2000.

7. Inter-institutional mobility suggests that universities in different regions of the country will experience faculty shortfall by varying degrees.

8. To begin to satisfy their own demand for PhD graduates, universities must expand their PhD programs and the number of PhD graduates at rates comparable to those of the 1980s.

9. Past trends indicate that retirement has been neither the only nor the principal cause of replacement demand. Departures for other reasons have been the main determinant of replacement demand. However, retirements explain an increasing proportion of departures from academe.

10. If universities retain faculty in greater numbers than they have up to now, there would be a net reduction in faculty requirements during the 1990s.

The cumulative effect of these characteristics poses a daunting challenge to the university community if it is to avert a serious faculty shortage. Universities will need to maintain and preferably increase their "market share" of PhD graduates and continue expanding their PhD programs, especially in the natural sciences where they appear to be particularly vulnerable.

Although gender differences were excluded from the analysis, gender is an especially important dimension on the supply side of the academic labour market equation. Already qualified female candidates are in short supply in numerous disciplines and entire fields of study. These problems will undoubtedly become more acute as the number of vacancies to be filled increases and universities struggle to implement employment equity policies. Women represent over one half of bachelor's degree recipients, but less than 30 percent of doctoral degree recipients. One means of helping to avert a faculty shortage would be to create conditions that would enable women to participate more fully in university education and research.

Resource allocation and labour market policies of governments need to recognize the growing demand for PhDs in both the academic and non-academic sectors. In fact, economic development goals and international competitive pressures require acceleration of the growth of Canadian PhDs in many fields.

Public support must be available to enable universities to continue to expand their PhD programs at the same rate as that of the 1980s. While universities are the only source of PhDs, they compete with other organizations in the economy (including government agencies) to hire and retain those PhD holders.

Universities need to find means of making academic life more attractive in order to reduce faculty attrition or "leakage" to other sectors. Empirical and qualitative studies need to be done to ascertain why faculty voluntarily leave academe. The results may reveal problems or shortcomings in academic life which are beyond the remedial powers of the universities. On the other hand, such studies may indicate steps that could be taken to reduce the number of vacancies by increasing retention. Greater retention will be particularly important if the need for faculty grows faster than projected.

Faculty shortages will be a very serious problem for Canadian universities over the course of the next decade. By threatening the quality of university education in Canada, such shortages could impede our ability to compete effectively in the 21st century with other countries with knowledge-intensive economies. The projected shortages can be averted if a series of appropriate actions are taken now.

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TABLE 1
Number of Full-time Appointments, 1976 to 1988

Year	New Recruits	Inter-Univ Mobility	Total
1976	1,884	775	2,659
1977	1,766	819	2,585
1978	1,580	820	2,400
1979	1,426	734	2,160
1980	1,580	658	2,238
1981	1,513	670	2,183
1982	1,438	789	2,227
1983	1,294	756	2,050
1984	1,330	828	2,158
1985	1,354	866	2,220
1986	1,624	979	2,603
1987	1,602	841	2,443
1988	1,828	954	2,782
Percentage Distribution			
1976	70.9%	29.1%	100.0%
1977	68.3%	31.7%	100.0%
1978	65.8%	34.2%	100.0%
1979	66.0%	34.0%	100.0%
1980	70.6%	29.4%	100.0%
1981	69.3%	30.7%	100.0%
1982	64.6%	35.4%	100.0%
1983	63.1%	36.9%	100.0%
1984	61.6%	38.4%	100.0%
1985	61.0%	39.0%	100.0%
1986	62.4%	37.6%	100.0%
1987	65.6%	34.4%	100.0%
1988	65.7%	34.3%	100.0%

Source: AUCC using Statistics Canada data

TABLE 2
Inter-institutional Mobility of Junior Faculty (Assistant)
by Region, Total 1984 to 1988

Region	Remaining in region	Moving to other region	Total	Recruited from other region	Net gain (loss)
ATLANTIC	207	138	345	271	133
QUEBEC	430	181	611	150	(31)
ONTARIO	1,106	485	1,591	390	(95)
WEST	562	315	877	308	(7)
CANADA	2,305	1,119	3,424	1,119	0
Percentage Distribution					
ATLANTIC	60.0%	40.0%	10.1%	24.2%	
QUEBEC	70.4%	29.6%	17.8%	13.4%	
ONTARIO	69.5%	30.5%	46.5%	34.9%	
WEST	64.1%	35.9%	25.6%	27.5%	
CANADA	67.3%	32.7%	100.0%	100.0%	

Source: AUCC using Statistics Canada data

TABLE 3
Inter-institutional Mobility of Senior Faculty (Full and Associate),
by Region, Total, 1984 to 1988

Region	Remaining in region	Moving to other region	Total	Recruited from other region	Net gain (loss)
ATLANTIC	25	68	93	48	(20)
QUEBEC	103	55	158	41	(14)
ONTARIO	191	82	273	157	75
WEST	99	108	207	67	(41)
CANADA	418	313	731	313	0
Percentage Distribution					
ATLANTIC	26.9%	73.1%	12.7%	15.3%	
QUEBEC	65.2%	34.8%	21.6%	13.1%	
ONTARIO	70.0%	30.0%	37.3%	50.2%	
WEST	47.8%	52.2%	28.3%	21.4%	
CANADA	57.2%	42.8%	100.0%	100.0%	

Source: AUCC using Statistics Canada data

TABLE 4
Distribution of New Full-Time Appointments by Previous Employment Sectors, 1976 to 1988

	Students in Canada	Unknown	Interna. Market	Other Cdn Markets	Total
1976	275	426	710	473	1 884
1977	276	281	686	523	1 766
1978	284	186	546	564	1 580
1979	234	247	475	470	1 426
1980	209	283	509	579	1 580
1981	157	348	484	524	1 513
1982	189	290	489	470	1 438
1983	179	246	430	439	1 294
1984	228	181	479	442	1 330
1985	227	242	417	468	1 354
1986	239	414	491	480	1 624
1987	241	388	489	484	1 602
1988	245	568	521	494	1 828
Percentage Distribution					
1976	14,6%	22,6%	37,7%	25,1%	100,0%
1977	15,6%	15,9%	38,8%	29,6%	100,0%
1978	18,0%	11,8%	34,6%	35,7%	100,0%
1979	16,4%	17,3%	33,3%	33,0%	100,0%
1980	13,2%	17,9%	32,2%	36,6%	100,0%
1981	10,4%	23,0%	32,0%	34,6%	100,0%
1982	13,1%	20,2%	34,0%	32,7%	100,0%
1983	13,8%	19,0%	33,2%	33,9%	100,0%
1984	17,1%	13,6%	36,0%	33,2%	100,0%
1985	16,8%	17,9%	30,8%	34,6%	100,0%
1986	14,7%	25,5%	30,2%	29,6%	100,0%
1987	15,0%	24,2%	30,5%	30,2%	100,0%
1988	13,4%	31,1%	28,5%	27,0%	100,0%

Source: AUCC using Statistics Canada data

TABLE 5
Distribution of New Full-time Appointments by Tenure Status and Previous Employment Sector, Total 1984 to 1988

	Students	Other Canadian Markets	International Market	Total
Tenured	141	366	523	1,030
Leading to Tenure	305	648	790	1,743
Annual, Sessional	725	1,337	1,071	3,133
Other	8	15	11	34
Unknown	1	2	2	5
Total	1,180	2,368	2,397	5,945
Percentage Distribution				
Tenure	11.9%	15.5%	21.8%	17.3%
Leading to	25.8%	27.4%	33.0%	29.3%
Annual, Sessional	61.4%	56.6%	44.7%	52.7%
Other	0.7%	.06%	0.5%	0.6%
Unknown	0.1%	0.1%	0.1%	0.1%
Total	100%	100%	100%	100%

Source: AUCC using Statistics Canada data.

Table 6
Distribution of Full-Time Faculty by Age Group, 1976 to 1988

	Under 35	35-44	45-54	55-64	Over 64	Unknown	Total	Average Age
1976	8,164	12,752	7,337	3,064	193	138	31,648	41.4
1977	7,506	13,285	7,793	3,346	200	37	32,167	41.8
1978	6,605	13,871	8,301	3,596	224	48	32,645	42.4
1979	5,924	14,044	8,700	3,846	231	58	32,803	42.9
1980	5,429	14,118	9,218	4,229	226	79	33,299	43.4
1981	4,897	14,086	9,721	4,601	239	55	33,599	43.9
1982	4,527	14,090	10,285	4,902	242	32	34,078	44.3
1983	4,114	13,747	10,803	5,305	274	37	34,280	44.8
1984	3,925	13,408	11,297	5,707	303	25	34,665	45.3
1985	3,781	13,010	11,922	6,060	376	22	35,171	45.7
1986	3,673	12,551	12,407	6,296	406	40	35,373	46.0
1987	3,583	11,870	13,057	6,591	454	49	35,604	46.3
1988	3,583	11,658	13,679	6,913	459	94	36,386	46.5
Percentage Distribution								
1976	25.8%	40.3%	23.2%	9.7%	0.6%	0.4%	100.0%	
1977	23.3%	41.3%	24.2%	10.4%	0.6%	0.1%	100.0%	
1978	20.2%	42.5%	25.4%	11.0%	0.7%	0.1%	100.0%	
1979	18.1%	42.8%	26.5%	11.7%	0.7%	0.2%	100.0%	
1980	16.3%	42.4%	27.7%	12.7%	0.7%	0.2%	100.0%	
1981	14.6%	41.9%	28.9%	13.7%	0.7%	0.2%	100.0%	
1982	13.3%	41.3%	30.2%	14.4%	0.7%	0.1%	100.0%	
1983	12.0%	40.1%	31.5%	15.5%	0.8%	0.1%	100.0%	
1984	11.3%	38.7%	32.6%	16.5%	0.9%	0.1%	100.0%	
1985	10.8%	37.0%	33.9%	17.2%	1.1%	0.1%	100.0%	
1986	10.4%	35.5%	35.1%	17.8%	1.1%	0.1%	100.0%	
1987	10.1%	33.3%	36.7%	18.5%	1.3%	0.1%	100.0%	
1988	9.8%	32.0%	37.6%	19.0%	1.3%	0.3%	100.0%	

Source: AUCC using Statistics Canada data

TABLE 7
Distribution of New Appointments by Growth and Attrition, 1977 to 1988

Year	Growth	Attrition	Total
1977	519	1,247	1,766
1978	478	1,102	1,580
1979	158	1,268	1,426
1980	496	1,084	1,580
1981	300	1,213	1,513
1982	479	959	1,438
1983	202	1,092	1,294
1984	385	945	1,330
1985	506	848	1,354
1986	202	1,422	1,624
1987	231	1,371	1,602
1988	782	1,046	1,828
Percentage Distribution			
1977	29.4%	70.6%	100.0%
1978	30.3%	69.7%	100.0%
1979	11.1%	88.9%	100.0%
1980	31.4%	68.6%	100.0%
1981	19.8%	80.2%	100.0%
1982	33.3%	66.7%	100.0%
1983	15.6%	84.4%	100.0%
1984	28.9%	71.1%	100.0%
1985	37.4%	62.6%	100.0%
1986	12.4%	87.6%	100.0%
1987	14.4%	85.6%	100.0%
1988	42.8%	57.2%	100.0%

Source: AUCC using Statistics Canada data

TABLE 8
Distribution of New Full-Time Appointments by Age Group, 1976 to 1988

	Under 35	35-44	45-54	55-64	Over 64	Unknown	Total	Average Age
1976	1,174	462	138	36	6	68	1,884	33.9
1977	1,127	439	142	39	6	13	1,766	34.1
1978	972	428	135	27	4	14	1,580	34.2
1979	874	394	108	31	4	15	1,426	34.3
1980	890	467	147	43	7	26	1,580	35.1
1981	839	491	113	39	5	26	1,513	35.0
1982	754	518	112	32	7	15	1,438	35.3
1983	707	435	105	31	2	14	1,294	35.2
1984	690	487	113	34	2	4	1,330	35.6
1985	716	484	105	43	5	1	1,354	35.6
1986	779	618	163	45	5	14	1,624	36.3
1987	806	595	141	42	2	16	1,602	35.9
1988	819	714	200	47	6	42	1,828	36.7
Percentage Distribution								
1976	62.3%	24.5%	7.3%	1.9%	0.3%	3.6%	100.0%	
1977	63.8%	24.9%	8.0%	2.2%	0.3%	0.7%	100.0%	
1978	61.5%	27.1%	8.5%	1.7%	0.3%	0.9%	100.0%	
1979	61.3%	27.6%	7.6%	2.2%	0.3%	1.1%	100.0%	
1980	56.3%	29.6%	9.3%	2.7%	0.4%	1.6%	100.0%	
1981	55.5%	32.5%	7.5%	2.6%	0.3%	1.7%	100.0%	
1982	52.4%	36.0%	7.8%	2.2%	0.5%	1.0%	100.0%	
1983	54.6%	33.6%	8.1%	1.4%	0.2%	1.1%	100.0%	
1984	51.9%	36.6%	8.5%	2.6%	0.2%	0.3%	100.0%	
1985	52.9%	35.7%	7.8%	3.2%	0.4%	0.1%	100.0%	
1986	48.0%	38.1%	10.0%	2.8%	0.3%	0.9%	100.0%	
1987	50.3%	37.1%	8.8%	2.6%	0.1%	1.0%	100.0%	
1988	44.8%	39.1%	10.9%	2.6%	0.3%	2.3%	100.0%	

Source : AUCC, avec données de Statistique Canada

TABLE 9:
Distribution of Faculty Attrition by Age Group,
1976 to 1987

	Under 35	35-44	45-54	55-59	60-64	Over 64	Total
1976	250	441	198	65	105	87	1,146
1977	353	333	134	55	141	94	1,110
1978	307	408	191	58	180	130	1,274
1979	297	354	129	36	141	126	1,083
1980	255	398	175	67	153	127	1,175
1981	122	267	154	66	192	135	936
1982	202	310	186	68	199	121	1,086
1983	57	291	186	54	236	133	957
1984	111	191	131	87	237	121	878
1985	137	336	241	176	353	183	1,426
1986	129	368	217	148	329	179	1,370
1987	23	174	182	163	314	221	1,077
Percentage Distribution							
1976	21.8%	38.5%	17.3%	5.7%	9.2%	7.6%	100.0%
1977	31.8%	30.0%	12.1%	5.0%	12.7%	8.5%	100.0%
1978	24.1%	32.0%	15.0%	4.6%	14.1%	10.2%	100.0%
1979	27.4%	32.7%	11.9%	3.3%	13.0%	11.6%	100.0%
1980	21.7%	33.9%	14.9%	5.7%	13.0%	10.8%	100.0%
1981	13.0%	28.5%	16.5%	7.1%	20.5%	14.4%	100.0%
1982	18.6%	28.5%	17.1%	6.3%	18.3%	11.1%	100.0%
1983	6.0%	30.4%	19.4%	5.6%	24.7%	13.9%	100.0%
1984	12.6%	21.8%	14.9%	9.9%	27.0%	13.8%	100.0%
1985	9.6%	23.6%	16.9%	12.3%	24.8%	12.8%	100.0%
1986	9.4%	26.9%	15.8%	10.8%	24.0%	13.1%	100.0%
1987	2.1%	16.2%	16.9%	15.1%	29.2%	20.5%	100.0%
1976 to 1979	26.2%	33.3%	14.1%	4.6%	12.3%	9.5%	100.0%
1980 to 1983	15.3%	30.5%	16.9%	6.1%	18.8%	12.4%	100.0%
1984 to 1987	8.4%	22.5%	16.2%	12.1%	26.0%	14.8%	100.0%

TABLE 10
Average Income of 1982 PhD Graduates in 1984 by Occupation

Occupation	Average Income
Managerial, Administrative	$41,005
Occupations in Natural Sciences	$36,016
Occupations in Social Sciences	$36,235
University Teaching & Related	$31,166
Other Teaching	$35,101
Other Occupations	$29,814
ALL OCCUPATIONS	$34,184

Source: Follow-up of 1982 Graduates Survey, Statistics Canada and Employment and Immigration Canada, 1987. Income data are for 1984.

TABLE 11
Percentage Distribution of 1982 PhD Graduates, by Occupation in 1986 and Major Field of Study

OCCUPATION	HUMAN SCIENCES	NATURAL SCIENCES	TOTAL
Managerial, administrative,	19.6%	10.0%	15.4%
Occupations in Natural Sciences,	2.1%	39.7%	18.6%
Occupations in Social Sciences,	19.4%	0.8%	11.2%
University Teaching & Related	44.7%	36.3%	41.0%
Other Teaching	8.7%	0.9%	8.6%
Other Occupations	5.6%	12.4%	8.6%
TOTAL	100%	100%	100%

Source: Follow-up of 1982 Graduates Survey, Statistics Canada and Employment and Immigration Canada, 1987.

TABLE 12
Percentage Distribution of All PhD Degree-Holders in Canada
by Major Field of Study, 1986

OCCUPATION	HUMAN SCIENCES	NATURAL SCIENCES	TOTAL
Managerial, administrative	16.6%	15.2%	15.8%
Occupations in Natural Sciences	2.1%	29.6%	16.9%
Occupations in Social Sciences	16.1%	2.0%	8.5%
Teaching & Related	53.3%	33.0%	42.4%
Other Occupations	12.0%	20.2%	16.4%
TOTAL (Number)	27,075	31,665	58,740

Source: 1986 Census, Statistics Canada

TABLE 13
Number of Canadian PhD Students by Field of Study,
1975 to 1988 and Projections to 1997

I - NATURAL SCIENCES

	Scenario 1	Scenario 2	Scenario 3
1975	3,376	3,376	3,376
1976	3,265	3,265	3,265
1977	3,041	3,041	3,041
1978	2,871	2,871	2,871
1979	2,936	2,936	2,936
1980	2,973	2,973	2,973
1981	3,045	3,045	3,045
1982	3,334	3,334	3,334
1983	3,747	3,747	3,747
1984	4,100	4,100	4,100
1985	4,472	4,472	4,472
1986	4,883	4,883	4,883
1987	5,157	5,157	5,157
1988	5,264	5,264	5,264
1989	5,507	5,507	5,507
1990	5,891	5,507	5,746
1991	6,254	5,507	6,069
1992	6,324	5,507	6,106
1993	6,348	5,507	6,098
1994	6,309	5,507	6,029
1995	6,336	5,507	6,025
1996	6,337	5,507	5,995
1997	6,333	5,507	5,961

Legend: Scenario 1: Constant PhD-to-bachelor's enrolment ratio
Scenario 2: Constant PhD enrolment
Scenario 3: Moderate growth of PhD-to-bachelor's enrolment ratio

TABLE 13 - continued

II - HUMAN SCIENCES

	Scenario 1	Scenario 2	Scenario 3
1975	4,374	4,374	4,374
1976	4,441	4,441	4,441
1977	4,329	4,329	4,329
1978	4,289	4,289	4,289
1979	4,417	4,417	4,417
1980	4,487	4,487	4,487
1981	4,546	4,546	4,546
1982	4,731	4,731	4,731
1983	5,002	5,002	5,002
1984	5,416	5,416	5,416
1985	5,634	5,634	5,634
1986	5,970	5,970	5,970
1987	6,316	6,316	6,316
1988	6,567	6,567	6,567
1989	6,682	6,682	6,861
1990	7,201	6,682	7,344
1991	7,835	6,682	8,071
1992	8,115	6,682	8,442
1993	8,476	6,682	8,905
1994	8,864	6,682	9,404
1995	9,249	6,682	9,911
1996	9,768	6,682	10,570
1997	10,241	6,682	11,192

Legend: Scenario 1: Constant PhD-to-bachelor's enrolment ratio
Scenario 2: Constant PhD enrolment
Scenario 3: Moderate growth of the PhD-to-bachelor's enrolment ratio

TABLE 13 - continued

III - TOTAL (ALL FIELDS)

	Scenario 1	Scenario 2	Scenario 3
1975	7,750	7,750	7,750
1976	7,706	7,706	7,706
1977	7,370	7,370	7,370
1978	7,160	7,160	7,160
1979	7,353	7,353	7,353
1980	7,460	7,460	7,460
1981	7,591	7,591	7,591
1982	8,065	8,065	8,065
1983	8,749	8,749	8,749
1984	9,516	9,516	9,516
1985	10,106	10,106	10,106
1986	10,853	10,853	10,853
1987	11,473	11,473	11,473
1988	11,831	11,831	11,831
1989	12,189	12,189	12,368
1990	13,092	12,189	13,090
1991	14,089	12,189	14,140
1992	14,439	12,189	14,548
1993	14,824	12,189	15,002
1994	15,173	12,189	15,434
1995	15,585	12,189	15,935
1996	16,105	12,189	16,565
1997	16,575	12,189	17,153

Source: AUCC using Statistics Canada data

Legend: Scenario 1: Constant PhD-to-bachelor's enrolment ratio
Scenario 2: Constant PhD enrolment
Scenario 3: Moderate growth of the PhD-to-bachelor's enrolment ratio

TABLE 14
Number of PhD Degrees Awarded to Canadians, Estimates to 1988 and Projections to 2000

I - NATURAL SCIENCES

	Scenario 1	Scenario 2	Scenario 3
1978	746	746	746
1979	722	722	722
1980	672	672	672
1981	634	634	634
1982	649	649	649
1983	657	657	657
1984	673	673	673
1985	737	737	737
1986	828	828	828
1987	906	906	906
1988	988	988	988
1989	1,079	1,079	1,079
1990	1,140	1,140	1,140
1991	1,163	1,163	1,163
1992	1,217	1,217	1,217
1993	1,302	1,217	1,270
1994	1,382	1,217	1,341
1995	1,398	1,217	1,349
1996	1,403	1,217	1,348
1997	1,394	1,217	1,333
1998	1,400	1,217	1,331
1999	1,400	1,217	1,325
2000	1,400	1,217	1,317

Legend: Scenario 1: Constant PhD-to-bachelor's enrolment ratio
Scenario 2: Constant PhD enrolment
Scenario 3: Moderate growth of the PhD-to-bachelor's enrolment ratio

TABLE 14 - continued

II - HUMAN SCIENCES

	SCENARIO 1	SCENARIO 2	SCENARIO 3
1978	691	691	691
1979	702	702	702
1980	684	684	684
1981	678	678	678
1982	698	698	698
1983	709	709	709
1984	718	718	718
1985	747	747	747
1986	790	790	790
1987	856	856	856
1988	890	890	890
1989	943	943	943
1990	998	998	998
1991	1,038	1,038	1,038
1992	1,056	1,056	1,084
1993	1,138	1,056	1,160
1994	1,238	1,056	1,275
1995	1,282	1,056	1,334
1996	1,339	1,056	1,407
1997	1,400	1,056	1,486
1998	1,461	1,056	1,566
1999	1,543	1,056	1,670
2000	1,618	1,056	1,768

Legend: Scenario 1: Constant PhD-to-bachelor's enrolment ratio
Scenario 2: Constant PhD enrolment
Scenario 3: Moderate growth of the PhD-to-bachelor's enrolment ratio

TABLE 14 - Continued

III- TOTAL

	SCENARIO 1	SCENARIO 2	SCENARIO 3
1978	1,437	1,437	1,437
1979	1,423	1,423	1,423
1980	1,356	1,356	1,356
1981	1,312	1,312	1,312
1982	1,347	1,347	1,347
1983	1,366	1,366	1,366
1984	1,391	1,391	1,391
1985	1,484	1,484	1,484
1986	1,618	1,618	1,618
1987	1,762	1,762	1,762
1988	1,878	1,878	1,878
1989	2,022	2,022	2,022
1990	2,138	2,138	2,138
1991	2,201	2,201	2,201
1992	2,273	2,273	2,301
1993	2,440	2,273	2,430
1994	2,620	2,273	2,616
1995	2,680	2,273	2,683
1996	2,742	2,273	2,755
1997	2,795	2,273	2,818
1998	2,862	2,273	2,897
1999	2,944	2,273	2,995
2000	3,018	2,273	3,086

Source: AUCC using Statistics Canada Data

Legend: Scenario 1: Constant PhD-to-bachelor's enrolment ratio
Scenario 2: Constant PhD enrolment
Scenario 3: Moderate growth of the PhD-to-bachelor's enrolment ratio

TABLE 15
Projections of PhD Graduates Available to Teach, 1989 to 2000

	SCENARIO 1	SCENARIO 2	SCENARIO 3
1989	813	813	813
1990	851	851	851
1991	868	868	868
1992	886	886	898
1993	942	877	941
1994	1,003	868	1,005
1995	1,017	860	1,022
1996	1,032	851	1,042
1997	1,045	843	1,060
1998	1,061	834	1,082
1999	1,084	826	1,111
2000	1,103	818	1,137

Source: AUCC using Statistics Canada data

Legend:
- Scenario 1: Constant PhD-to-bachelor's enrolment ratio assuming a declining academic share
- Scenario 2: Constant PhD enrolment assuming a declining academic share
- Scenario 3: Moderate growth of the PhD-to-bachelor's enrolment ratio assuming a declining academic share

Table 16: Projected New Appointments, 1989 to 2000

Faculty Growth Rate Scenarios

	Base projection 1.2% per year	No growth beginning in 1989	Slow growth falls to 0.5% by 2000	Faster growth increases to 2.0% by 2000
1989	1,732	1,302	1,711	1,757
1990	1,756	1,308	1,713	1,807
1991	1,791	1,325	1,725	1,870
1992	1,831	1,347	1,740	1,940
1993	1,874	1,373	1,757	2,015
1994	1,919	1,402	1,775	2,093
1995	1,965	1,431	1,793	2,175
1996	2,012	1,460	1,810	2,260
1997	2,058	1,489	1,826	2,346
1998	2,104	1,517	1,840	2,435
1999	2,149	1,544	1,852	2,525
2000	2,193	1,570	1,863	2,618

Entry Rate Scenarios

	Base	Hire younger	Hire older	Equal age distribution of new appointees
1989	1,732	1,732	1,732	1,732
1990	1,756	1,758	1,800	1,864
1991	1,791	1,794	1,866	1,973
1992	1,831	1,836	1,932	2,070
1993	1,874	1,881	1,999	2,163
1994	1,919	1,928	2,068	2,254
1995	1,965	1,976	2,137	2,344
1996	2,012	2,025	2,208	2,433
1997	2,058	2,073	2,278	2,522
1998	2,104	2,121	2,348	2,609
1999	2,149	2,168	2,416	2,695
2000	2,193	2,214	2,483	2,778

Exit Rate Scenarios

	Base projection 1.2% per year	Increase retention by 15%	Increase exit rates by 15%	Early retirement	Hire younger & reduce exits of older/younger	Hire older & reduce exits of older
1989	1,732	1,558	1,907	1,892	1,567	1,520
1990	1,756	1,596	1,911	1,697	1,591	1,584
1991	1,791	1,639	1,937	1,742	1,627	1,649
1992	1,831	1,684	1,972	1,790	1,669	1,715
1993	1,874	1,730	2,012	1,838	1,714	1,781
1994	1,919	1,778	2,054	1,887	1,760	1,848
1995	1,965	1,826	2,099	1,935	1,807	1,916
1996	2,012	1,874	2,143	1,984	1,853	1,985
1997	2,058	1,923	2,188	2,032	1,899	2,053
1998	2,104	1,970	2,232	2,079	1,943	2,121
1999	2,149	2,017	2,276	2,125	1,985	2,189
2000	2,193	2,062	2,319	2,171	2,026	2,255

Source: AUCC using Statistics Canada data

Table 17
Total Faculty by Age Group, Actual for 1988 and Projections for 2000 Using Base Scenario

	Number		Proportion	
	1988	2000	1988	2000
20-24	39	0	0.1%	0.0%
25-29	588	19	1.6%	0.0%
30-34	2,956	2,530	8.1%	6.1%
35-39	5,014	4,155	13.8%	9.9%
40-44	6,644	6,173	18.3%	14.8%
45-49	7,720	8,830	21.3%	21.1%
50-54	5,959	7,878	16.4%	18.8%
55-59	4,313	6,791	11.9%	16.2%
60-64	2,600	4,672	7.2%	11.2%
65-69	427	721	1.2%	1.7%
70-74	27	30	0.1%	0.1%
75-79	5	3	0.0%	0.0%
Total	36,292	41,801	100.0%	100.0%

Source: AUCC using Statistics Canada data

TABLE 18
Projections of Faculty Supply and Demand, 1989 to 2000

	SCENARIO 1	SCENARIO 2	SCENARIO 3	BASE DEMAND
1989	813	813	813	789
1990	851	851	851	815
1991	868	868	868	846
1992	886	886	898	880
1993	942	877	941	917
1994	1,003	868	1,005	956
1995	1,017	860	1,022	996
1996	1,032	851	1,042	1,038
1997	1,045	843	1,060	1,080
1998	1,061	834	1,082	1,124
1999	1,084	826	1,111	1,168
2000	1,103	818	1,137	1,212

Source: AUCC using Statistics Canada data

Legend:
- Scenario 1: Constant PhD-to-bachelor's enrolment ratio assuming a declining academic share
- Scenario 2: Constant PhD enrolment assuming a declining academic share
- Scenario 3: Moderate growth of the PhD-to-bachelor's enrolment ratio assuming a declining academic share
- Base Demand: Projected demand for recent PhD graduates

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